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EDITORIAL

THOUGHTS ON THE FUTURE

THE year which is about to pass has been one in which a sorely tried world has strained to encompass and control those forces of distrust and enmity which are for ever straining towards man's destruction. The world should be the home of one big, happy family, in which the members live in harmony and security, with the spirit of "give and take" transcendent so that all spare energy could be allocated to the advancement of the common good. Many strain to this end, some just view it as would a wishful thinker, others are apathetic, consoling themselves with the thought that visions and dreams are illusory and bear no relation to actual fact.

In one sphere, however, we have witnessed some of these ideals come to pass. The veterinary profession throughout the world has set an example fully illustrating the benefits which can accrue when confidence, harmony and mutual aid becomes international. Never has the inter-change of ideas and good comradeship been so exemplified as it has been in 1952. Great work has been done. At home also there has been cause for congratulation. The country has emerged triumphant from a severe visitation of Foot and Mouth Disease. The Veterinary Department of the Ministry of Agriculture has reason to be proud of this conquest, but there can be no doubt that the result was only effected by the whole-hearted collaboration of all concerned, *ie.*, the members of the Animal Health Division and the practitioners.

Let us hope that the true spirit of Christmas will spread this time throughout the world and that we may look forward to a new year in which the present shadows may disperse so that men, free from anxiety, may strive towards the ideal.

(*The November issue of The British Veterinary Journal was published on November* 14)

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GENERAL ARTICLES

OBSERVATIONS ON THE BEHAVIOUR OF RINDERPEST VIRUS IN INDIGENOUS AFRICAN SHEEP

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Introduction

THE exportation of sheep on the hoof or as carcasses from countries where rinderpest is enzootic to those free from the disease can only be considered a safe procedure if it is shown that infection cannot be disseminated by this means. Veterinary police measures for rinderpest control in Kenya, applied with undoubted success, have been based on the assumption that sheep neither suffer from the disease naturally nor contract latent infection. The resistance and infectivity of the virus is such that mechanical transfer of contagion by sheep is also not generally considered to be of importance.

A re-examination of the potential role of the sheep in rinderpest epizootology seemed desirable in view of the possible export of mutton from territories of Eastern Africa, and, following some preliminary work in British Somaliland, carried out by Mr. D. L. MacFarlane, M.R.C.V.S., on behalf of the Ministry of Agriculture and Fisheries, United Kingdom, and the Director of Agriculture and Veterinary Services of that territory, all further investigations were conducted at Kabete.

Surveys of the available literature, especially that in Curasson's (1932) monograph, reveal conflicting opinions on the natural and artificial susceptibility of the sheep to rinderpest virus. Whilst many older authors reported natural outbreaks in sheep, sometimes with high mortality, no recent and authenticated instances are cited. Ware (quoted by Jackson and Cabot, 1929), in India, stated that outbreaks were reported to him, but that he was never able to find cases of ovine rinderpest in villages where bovine rinderpest was rampant. Blood from sick sheep was also non-infective for bovines. Walker (1929) refers to the assumption in Kenya that sheep have no importance in the spread of rinderpest.

Curasson (1932) and Hall (1933), especially the former, review the attempts at artificial transmission of the disease to various types of sheep, and the general conclusion is that although sheep may be infected, the only evidence is commonly a transitory rise of temperature and occasionally a mucopurulent nasal discharge. The variation in the response of different breeds, especially indigenous as opposed to exotic types, is also of some note. Individual animals vary somewhat in their susceptibility to artificial infection, and Curasson (1932) states that the indigenous African sheep (and goat) is affected severely only in exceptional instances.

The same author found that his repeated attempts to infect sheep by placing them in prolonged contact with reacting bovines were unsuccessful. Walker

(1929) made a similar observation and showed that virus is not present in the urine or fæces of inoculated sheep, and in-contact cattle did not acquire the disease. It is also generally conceded that sheep-to-sheep transmission does not occur naturally, but that subinoculation from sheep to sheep may be successful.

Personal Observations

Materials and Methods.

All sheep were of the indigenous fat-tailed, hairy type (Black-headed Persian), brought south from the Northern Frontier district of Kenya for slaughter in Nairobi. They were usually in good condition and young (2-4 tooth). Cattle were high-grade European stock, commonly about two years old and of 350-500 lb. live-weight. Sheep were housed several days before inoculation to allow their temperatures to settle down. The temperature of all cattle and sheep used was taken twice daily.

The Kabete strain of rinderpest virus employed here produces in fully susceptible cattle a temperature reaction which commences from 24 to 72 hours following subcutaneous inoculation of 1 g. of spleen pulp, equivalent to approximately 10,000 to 100,000 M.L.Ds. Such a quantity in the form of a 20 per cent saline emulsion is the usual challenge dose.

Needle passage over a period of 20 years or more has so reduced the contagious properties of this strain that it has become usual at this laboratory to regard rinderpest reactions arising within 10 days of inoculation as due to the inoculum and not to contact infection. With the very large numbers of cattle employed, it is not possible to maintain conditions of strict isolation, and a small trial was carried out to test the validity of the above assumption.

Three cattle were placed in boxes used to house virus makers until the latter were killed on the 4th day following inoculation. On the 13th day not one had shown any reaction. The three animals were then transferred to a single box together with an inoculated animal which was allowed to stay until it died 11 days later. From the temperature record of this animal, it was probably excreting virus from the 15th day of the experiment. Two of the in-contact animals contracted rinderpest on the 27th and 33rd days of the experiment, i.e., after minimum incubation periods of 12 and 18 days respectively. The other had failed to do so by the 41st day and was still susceptible on challenge at that date.

It is also of note that the Kabete strain of virus never, at the present time, produces mouth lesions of rinderpest in cattle. Intestinal lesions of varying intensity are commonly seen, together with the typical symptoms other than the stomatitis. It was not, therefore, to be expected, should sheep develop rinderpest in a characteristic form, that mouth lesions would occur with Kabete virus.

Experiment I

In this preliminary experiment the object was to observe the effect on sheep of inoculation with virulent rinderpest virus (Kabete strain) and to find the time of its persistence by subinoculation of pooled blood into bovines.

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A group of 12 sheep was housed in a single loose-box; of these, 10 received varying doses of pooled virulent blood from two reacting cattle which had been inoculated with 5 c.c. of a 20 per cent bovine spleen emulsion four days previously (see Table I). The other two sheep acted as in-contact controls for

TABLE I

Reaction in Sheep to Virulent Rinderpest Blood.

Sheep No.	Dose of virulent blood.	Temperature reaction. Days post-inoculation
252	5 c.c.	5
253	"	3 x 4*
254	"	Nil
255	"	3 x 5
256	10 c.c.	5, 17, 18
257	"	Nil
258	"	Nil
259	"	Nil
260	20 c.c.	Nil
261	"	Nil
262	Control	Nil
263	Control	18, 19, 20

* Died during 4th day, possibly with Nairobi sheep disease.

temperature changes. Two inoculated sheep (Nos. 253 and 255), which showed a temperature reaction commencing on the 2nd day, were bled on the 3rd day post-inoculation; all surviving inoculated sheep were bled daily from the jugular vein from the 4th to the 10th days, inclusive. Ten c.c. from each was pooled and 5 c.c. of the mixed product was inoculated immediately into two cattle, one susceptible and one immune to rinderpest. A reaction was judged to have occurred when the morning temperature reached 104° F. or above. All previously susceptible cattle which survived were challenged (with 1 g. virulent spleen emulsion, Kabete virus) 11 to 16 days after inoculation.

Results

Table I shows all those occasions on which a morning temperature of 103° F. or higher was recorded in the sheep during the 24 days following inoculation. No untoward effects were observed clinically in the inoculated or control sheep; a slight muco-purulent nasal discharge was present in most of them from the beginning of the experiment. This was probably associated with infestation with *Œstrus ovis* larvæ, which are of extremely widespread occurrence in Kenya sheep.

The animal No. 253 died on the evening of the 4th day, post-mortem examination revealing tumour splenis, intense hæmorrhagic gastritis and hæmorrhages in the heart and lungs. Since these lesions recalled, to some extent, those

of Nairobi sheep disease, spleen emulsion was subinoculated into two other sheep. One of these (No. 227) died of bloat on the next day; the other, No. 228, showed a temperature reaction on the 2nd to 5th days, from which it recovered. Unfortunately, this animal was found subsequently to have been already inoculated with Nairobi sheep disease virus, so that the presence or absence of this agent could not be established. On the 7th day, 10 c.c. of blood from No. 228 was non-infective for a rinderpest susceptible bovine.

The slight temperature reactions in sheep Nos. 256 and 263 between the 17th and 20th days were not further investigated. They were probably due to an intercurrent infection.

TABLE II.

Result of Subinoculation of pooled Blood from Sheep to Susceptible cattle.

Day	Reaction	Incubation Period	Result.
3	+	3 days	Died 16th day.
4	+	5 "	Killed in extremis 23rd day.
5	+	4 "	Destroyed in extremis 18th day.
6	+	5 "	Died 11th day.
7	+	6 "	Survived.
8	+	5 "	"
9	+	7 "	"

Table II gives the results of subinoculation of cattle. It will be seen that virus was present in the two reacting sheep on the 3rd day and persisted in the pooled blood of the nine inoculated survivors until the 9th. The gradual lengthening of the incubation period in bovines, as possibly also the falling off in mortality, indicates a decline in the quantity of virus from the 4th day onwards. On the 10th day the "susceptible" animal used was found on challenge to have a degree of immunity. Such cattle are found with varying frequency in those purchased as non-immune by the laboratory; their inclusion is difficult to avoid consistently in a country like Kenya where rinderpest prophylactics are in universal employ.

Experiment II

This was an amplification of Experiment I to ascertain the frequency of the transitory viræmia in a group of sheep following their inoculation with Kabete rinderpest virus.

Six of a group of eight sheep were inoculated with 5 c.c. of virulent bovine blood. They were housed in a single box and 5 c.c. of blood was removed daily by syringe from the jugular vein from the 3rd to the 6th day (inclusive) following their inoculation. A separate syringe and needle was used for each sheep and subinoculation was carried out immediately into a rinderpest susceptible bovine. Further inoculations of pooled blood were carried out on the 14th and 18th days (see Table III).

All typical bovine rinderpest reactors were killed for formalinised spleen vaccine production; non-reactors and atypical reactors were challenged 12 to 15 days later with Kabete virus.

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Table III summarises the results observed in sheep. Sheep No. 338 showed a temperature reaction and lesions typical of heartwater. Rickettsiæ were numerous in brain-squash preparations. It is probable that the infection was acquired in transit to Nairobi from the arid Northern Frontier District, which is itself free from the disease. It is noteworthy that this was the only inoculated sheep in which virus could not be demonstrated on the 3rd day. Sheep No. 339 at post-mortem examination on the 9th day showed only a pneumonia and slight congestion of the abomasal folds. No significant clinical changes were observed in the rest of the sheep apart from the inconsistent and slight rises of temperature.

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TABLE III.

Subinoculation of Blood from Individual Sheep to Cattle.

SHEEP No.	Temp. Reaction Days P.I.	Day 3	4	5	6	14	18	REMARKS
334	2, 5, 4, 5	½(7)	½(3)	½(3)	½(4)	I	-(P)	
335	-	½(5)	½(4)	½(4)	½(4)	I	-(P)	
336	3, 5, 6, 7	½(6)	½(3)	½(4)	½(5)	I	-(P)	
337	5.	½(5)	½(3)	½(3)	½(4)	I	-(P)	
338	2.	-	Dead					Died 3rd day of Heartwater.
339	3-7 (Incl.)	½(6)	½(4)	½(4)	I			Died 9th day of Pneumonia.
332	4, 7, 25.	-	-	-	-	½5(P)	-(P)	(In-Contact.
333	-	C	-	-	-	½5(P)	-(P)	Controls.

C. = Reaction day 10 following inoculation - probably contact infection

I. = Bovine subsequently found to be immune to challenge.

N. = Not carried out.

P. = Pooled sample.

Figures in brackets indicate the time in days to first significant temperature rise.

The results of cattle inoculations are also shown in Table III.

Using the incubation period in the cattle as a criterion, in five of the six inoculated sheep, virus was present in greater quantity on the 4th day than on the 3rd; it was maintained on the 5th day and began to decrease again on the 6th. In one of the five it was not demonstrated on the 6th day as the bovine used was afterwards found to have been immune.

The reaction of the bovine inoculated on the 3rd day with blood from sheep No. 333 was considered to be a case of contact infection; it was proved by subinoculation to have been due to rinderpest virus.

Pooled blood from the two in-contact control sheep, withdrawn on the 14th day, caused a temperature reaction commencing on the 3rd day in bovine No. 907. It died on the 6th day and the post-mortem lesions were suggestive of rinderpest caused by the Kabete strain of virus. No virus was detected in the control or inoculated sheep on the 18th day.

Experiment III

The object here was to determine the difference, if any, between the Kabete strain and a recently-isolated field strain of rinderpest virus, on inoculation into sheep. At the same time the infectivity to cattle of such inoculated sheep was investigated.

The field strain of virus used (T.F.) was in its fourth laboratory passage; it had shown a tendency to produce after inoculation a long, slow temperature

rise, and four of six animals inoculated with it had recovered. The mortality rate with Kabete virus is probably well over 50 per cent in fully susceptible animals.

Four of six sheep were inoculated subcutaneously with 5 c.c. of the blood of bovine No. 1253, which had received nine days previously virulent spleen emulsion from a third passage of the above strain. At the time of bleeding, it had been reacting 48 hours. Subinoculations of blood were carried out as in Experiment II from all six sheep (Table IV). Five c.c. was the quantity subinoculated in each case. The bleeding was carried out in a separate loose-box and all traces of spilled blood were swabbed off the wool with 5 per cent lysol

TABLE IV.

Subinoculations with Field strain of Virus. (*continued*)

SHEEP	TREATMENT	TEMP. REACTION (Days P.I.)	3	4	5	6	7	8	9	11	15	18	21	25	28
402	Inoculated	-	-	I	-	½(7)	#	-	-	I	-	-	I		-(P)
403	"	-	-	½(6)	-	-	-	-	-	I	-	-	I		-(P)
404	"	5,6,32	½(5)	½(6)	½(5)	½(4)	½(5)	½(7)	½(8)	I	-	-	I		-(P)
405	"	42	½(9)	-	½(6)	½(4)	#	-	C	I	-	-	I		-(P)
406	Control	28,29	I	I	-	I	I	I	-	-	-	-	-		½(3)
407	"	42	I	I	I	I	I	I	-	-	-	-	I	-	-

# = Slight reaction days 9 - 11. Thereafter immune to challenge. These two animals were thought probably to be partially immune prior to the first inoculation.
C = Reaction days 15 - 18 - afterwards immune to rinderpest. Probably contact infection.
I = No subinoculation carried out.
I = Bovine found to be immune on subsequent challenge.
P = pooled sample.

before returning the animals to the loose-box. This was in an effort to prevent contact infection by a method not likely to arise in practice. Two susceptible cattle were housed together with the sheep from the 3rd to the 24th days. They had not then reacted, and when challenged with Kabete virus both were fully susceptible. Cattle used for the subinoculations were disposed of as in Experiment II; those inoculated in any one day were housed in a separate stall.

All six sheep were given 5 c.c. subcutaneously of virulent bovine blood (Kabete strain) on the 33rd day, and the presence of virus investigated by injection into cattle of pooled blood samples (10 c.c. and 20 c.c. respectively) of the control and re-inoculated groups. The results are also recorded in Table IV.

One sheep (No. 404) of the four inoculated in the first instance showed a slight temperature rise on the 5th and 6th days. This was also one of the only two where virus was recovered on more than one occasion, and it was apparently present in greatest quantity about the time of the rise in temperature and diminished after the 6th day.

The interpretation of the results in cattle is made less certain by the fact that the incubation periods in five of the 13 reactors was between seven and 10 days. As has been noted before, however, contact infection by Kabete virus in these stalls is rarely observed in less than 10 days following the introduction of susceptible cattle—however intense the exposure may be. The T.F. strain of virus used here never produced on inoculation such rapid reactions as are usual with Kabete virus; on the other hand, its ability to produce equally or more rapid contact infections was never tested. It is perhaps significant that no case of rinderpest arose in the 16 cattle used between the 11th and 31st days.

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Virus was never recovered from the in-contact control sheep on any of the seven occasions between the 5th and 31st days of the experiment, when subinoculations were carried out.

Following the re-inoculation on the 33rd day, no virus was demonstrated in a pooled blood sample from the four sheep. This rapid disappearance of the virus as compared with the results in " clean " sheep points to the acquisition of some immunity as a consequence of the first injection, even where this was followed only by a very transitory viræmia.

Only one of the control sheep reacted to the " challenge " dose. It showed a sudden marked temperature rise on the 4th day following inoculation, which was maintained until the 6th day, when it died. Blood from this sheep on the 5th day produced a typical rinderpest reaction within three days in a susceptible ox; on the 6th day its spleen was found to be infective to a rinderpest-susceptible bovine (within four days), but not to an immune animal. Hence rinderpest virus was present throughout the course of an acute and fatal reaction in a sheep.

Since, however, the lesions found at post-mortem examination were suggestive of Nairobi sheep disease, a spleen emulsion was injected later into two more sheep. Both of these reacted with a rise of temperature starting within 24 hours, and both died within 72 hours. The rapidly fatal course and lesions of this condition were identical with those produced by a disease agent isolated in Kabete at about this time from goats. The course in this infection of the latter species was also very rapid and invariably fatal; the condition could easily be transferred from goats by spleen or blood inoculation to sheep, which invariably succumbed very rapidly. This disease was not transmissible by contact and had no ætiological relationship to Nairobi sheep disease or to other recognised virus diseases of sheep. It could not be set up in cattle. The probable concurrence of this agent with rinderpest in sheep No. 406 was thought to be due to the attachment of a tick which had become infected from other sheep or goats. It is important to recognise the probability that death in this sheep was not due to rinderpest virus; the other agent, easily transmissible to sheep, was the lethal one, but did not suppress the multiplication of the rinderpest virus. Stress has been laid on this incident, since nowhere else in the course of this work was unequivocal evidence obtained that rinderpest virus alone could produce a severe or fatal infection of sheep.

Discussion

Of 22 indigenous Kenya sheep inoculated with rinderpest virus for the first time, nine showed slight temperature reactions definitely attributable to the virus. The rise of temperature was noted between the 2nd and 7th days following injection, most commonly however, on the 3rd to 5th days. One sheep (No. 338) died of heartwater, another (No. 339) with a broncho-pneumonia; No. 253 possibly died of Nairobi sheep disease, and a fourth (No. 406) was shown to have harboured an agent rapidly lethal to sheep, in addition to rinderpest virus. If these four animals are excluded, it can be said that the only effect

of the inoculation was a transitory rise of temperature. No other observable disturbances were noted.

When blood from 10 individual sheep was injected into rinderpest-susceptible cattle, virus was shown to have been present in all instances on at least one occasion, with the exception of a single animal which died very early of heartwater. In two of the 10 sheep recovery of virus was successful only on one day.

Subinoculations were commenced only on the 3rd day when it was considered that virus introduced with the original inoculum would have disappeared should the sheep be a completely refractory recipient. There are in fact indications from the cattle incubation periods that the quantity of virus increases to a maximum at the 5th to 6th days; it persisted at least until the 9th day, and had disappeared by the 13th day. There is no obvious correlation between the presence of virus and temperature reactions.

The results of subinoculations of blood from control sheep Nos. 332 and 333 on the 14th day following inoculation of their experimental fellows can only mean that sheep can acquire infection from other reacting sheep. It should be pointed out, however, that the conditions of exposure were very severe, all eight animals being housed in a single loose-box which was never disinfected during the course of the experiment. No similar evidence of sheep-to-sheep contact infection was obtained in Experiment III, using a field strain of virus, neither did susceptible cattle acquire the disease in 21 days' close contact with inoculated sheep. This latter finding accords well with those of Walker (1929) who employed Merino sheep, generally regarded as more susceptible. Walker (1922 and 1929) found no virus in the urine and fæces of reacting sheep and failed to observe sheep-to-sheep transmission.

Summary

(2) Two strains of rinderpest virus were inoculated into indigenous African sheep. An inconstant and slight rise of temperature was the only effect observed.

(2) The frequency and duration of viræmia were investigated by subinoculation of blood into cattle.

(3) Contact infection of sheep from reacting sheep occurred on one occasion. Cattle in contact with reacting sheep did not develop rinderpest.

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SOME ASPECTS OF LOSSES IN FARM ANIMALS

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THE existing pattern of British agriculture is the product of historical changes too numerous to mention in an article of this type. Attention should, however, be drawn to such events as the introduction of fodder root crops, pasture herbage plants, refrigeration and the development of corn growing in the North American continent, all of which have had far-reaching effects upon the agricultural industry in this country.

The provision of fodder supplies sufficient to carry the majority of the animals over the winter period and the control of such diseases as rinderpest, contagious pleuro-pneumonia, glanders, etc., have made improvement of livestock possible in this country.

Increases in population, changes in public taste, etc., have resulted in a change in the pattern of the industry. This, in turn, has led to changes in the nature and extent of the losses occurring amongst the livestock.

Information concerning animal production can be computed from a number of sources; amongst the most important are the quarterly returns of the Ministry of Agriculture, published on a county and a parish basis. The Milk Marketing Board publishes information on milk production on a regional and county basis and through the agency of its National Milk Records Scheme, provides data on individual yields, breed averages, etc. Since their inception in 1940 the meat production records of the Ministry of Food are a valuable source of information. Other schemes involving price controls, subsidies, etc., provide information on such items as wheat, wool and egg production. Artificial insemination projects can yield information on certain aspects of animal production. Finally, Agricultural Economic Departments situated at agricultural colleges and universities publish data on many aspects of the costs of animal production.

Sources of information are available from which it is possible to determine losses in farm animals and in animal production. The reports issued by the Chief Veterinary Officer of the Ministry of Agriculture contain information relating to the incidence of certain notifiable infectious diseases. In addition surveys have been made on the incidence of calf mortality,[1] infertility,[2] mastitis,[3] and general wastage.[4] An examination of the records of the intake into knackeries[5] gives a picture of the losses occurring in the areas served by these organisations. Unfortunately, these sources give an incomplete picture as not all losses in animals and in animal production are recorded.

A study of certain aspects of animal production in relation to land utilisation in the three South Wales counties of Cardiganshire, Carmarthenshire and Pembrokeshire has been carried out by Phillips.[6] This is a region of approximately 1¼ million acres of farming area (crops, grass and rough grazing) support-

ing a stock population of approximately 300,000 cattle and 500,000 sheep. Thirty per cent of the area is rough grazing and approximately 30 per cent of the remainder is under tillage. The region is a peninsula and because of the high mountain ranges on the easterly border there are relatively few roads and exits to the mainland of this island. It is therefore a remarkably self-contained region with its surplus production in stock and stock products, migrating towards the more highly populated and industrialised parts of the east. It has a wide range of elevation and consequently a wide variety of climate and micro-climate. In general, its geology is simple (apart from the S.W. strip), its population scattered, its production extremely variable and its animals relatively free from tuberculosis. Livestock farming has been the traditional system within the area with an emphasis on the rearing of cattle, horses, sheep and pigs. The coastal fringe has a reputation for corn growing in the form of wheat and barley as cash crops. The development of railways in the latter half of the 19th century increased the number of farms which were able to supply fresh milk to the industrial population of S. Wales. This led to the construction of milk factories along the main lines of railways. The establishment of the Milk Marketing Board, stabilisation of milk prices and a national policy directed towards this end have accelerated a change over to milk production with the result that three-quarters of the farms within the area are now concerned with dairying. Production of milk rather than store cattle has led to changes in the prevalent breeds of cattle leading to an increase in the numbers of Friesian, Ayrshire and Channel Island animals. Increased mechanisation of methods of production has resulted in a reduced horse population. Sheep farming still prevails in the upland regions but changes within the system have been brought about by increased lamb and reduced wether production.

The results of the aforementioned survey have confirmed previous estimates that production within the region is characterised by low output per acre, is seasonal in delivery, variable in amount and is subject to many and varied losses.

In this article attention has been drawn to certain aspects of the problem of animal losses with particular reference to the cattle population in Mid and West Wales. The material for the article has been derived from the sources mentioned above.

Results

(*a*) *Output*

As previously stated meat and milk production in the three counties of Caradigan, Carmarthen and Pembroke is relatively low in output per acre. Figure 1 illustrates the annual deliveries of cattle, sheep and calves through the 25 collecting centres in these three counties for the ten years 1940 to 1949.

The histogram shows that during the 10-year period 1.87 million sheep, 0.66 million calves and 0.24 million cattle were produced from the $1\frac{1}{4}$ million acres of farming area (crops, grass and rough grazing). This represents an output of a trifle more than 1/10th of a sheep per acre per annum and a correspondingly low figure for cattle. In addition to these entries into the grading centres

there are sales of milk, store cattle and sheep and sales of breeding stocks of sheep and cattle. Milk sales are the most important items of revenue at the present time ,although in terms of output the milk produced amounts to only 60 to 70 gallons per acre per annum when distributed over the whole area of crops and grass.

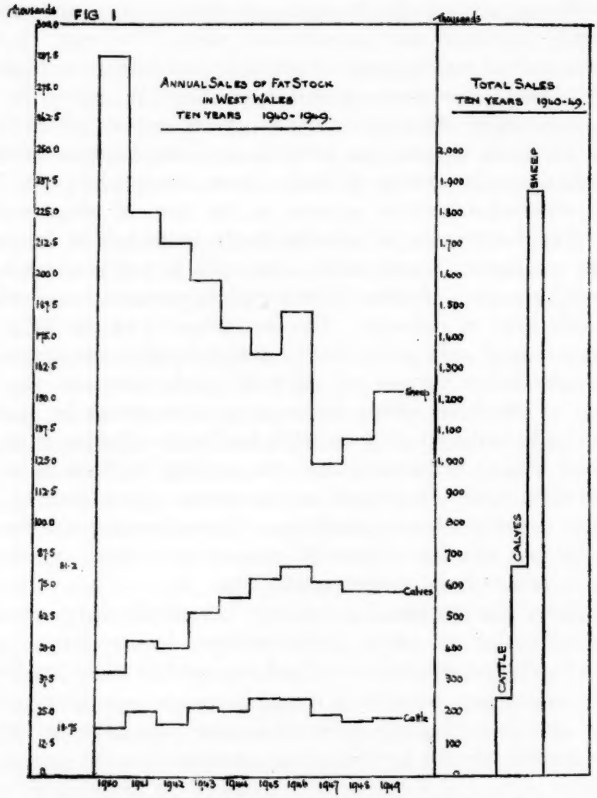

Figure 1 also shows the changes in the sales during the 10-year period; a sharp decline in sheep and a rapid increase in the sale of surplus calves. The gap between the calf and the sheep sales tends to narrow, whilst that between the calves and cattle widens from year to year which means that the calf sales continue to increase whilst the other two decline.

Finally, Figure 1 discloses the extent of the damage to production caused by the severe weather condition of 1946-47 whilst illustrating also the rapidity of the recovery.

(b) The Seasonality of Production

Figure 2 shows the average monthly sales for the six-year period 1943-8. The peak sales of cattle and sheep occur in the autumn during the last three months of the year although January is also reasonably high in sheep as September

is in cattle. 62.9 per cent of the total sales of cattle occur during the four months September to December, and 63.2 per cent of the total sales of sheep from October to January. The lowest sales occur in late spring and early summer. Meat is therefore mainly a grassland product and under existing circumstances it is difficult to see how this high seasonality can be altered. Nowadays the main supply of mutton is derived from the hill and upland pastures. The relative importance of the lowland summer milk fed lambs has diminshed with the increasing popularity of dairying.

FIG. 2.

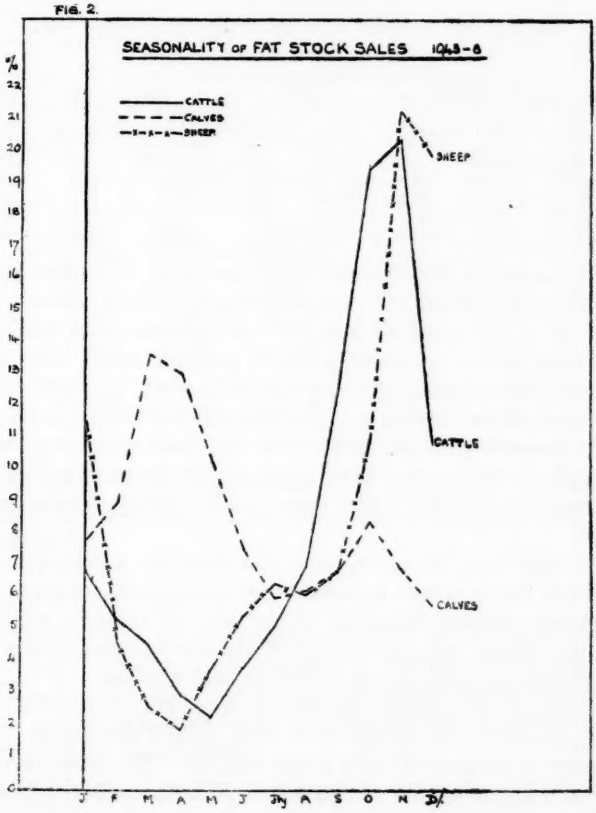

Figure 2 also depicts the distribution of the sales of calves throughout the six-year period 1943-48; it will be seen that the seasonal distribution is different from the sales of cattle and sheep. The peak deliveries occur during the three spring months March to May when 45.4 per cent of the total supplies are delivered. There is a small secondary peak in October, which is indicative of the success or failure of attempts to secure autumn calvings in the herds in this region. It is quite different from seasonality curves for Eastern England

(Phillips).[7] Spring calving is the order in the herds of this area and the bulk of the milk is produced in the summer.

(c) The Nature of the Production

The live weights and the gradings of all categories of cattle accepted on the hoof have been examined, yielding information on the body size and the condition of the animals. The grades refer to the S. or Special, and grades A, B and C as determined by the official graders of the Ministry.

The details for each category are given in the following table.

TABLE 1

Average live weights and percentage grading of the categories of fat cattle (1943-48).

	Cows		Cow Heifers		Bulls		Steers		Heifers	
Gde.	Av. Live Wt.	% Grading	Av. Live Wt.	% Grading	Av. Live Wt.	% Grading	Av. Live Wt.	% Grading	Av. Live Wt.	% Grading
S	1124.7	10.4	1112.2	1.4	1183.9	3.9	1358.1	12.3	1118.3	5.3
A	1196.8	15.1	1055.8	18.1	1669.4	48.1	1206.2	59.4	1026.3	37.8
B	1106.0	41.3	966.6	60.2	1446.5	38.2	1026.7	27.1	884.5	52.4
C	1044.4	33.2	889.8	20.3	1319.8	9.8	873.4	1.2	783.5	4.5
Av.	1109.8	100.0	971.3	100.0	1530.9	100.0	1172.6	100.0	946.2	100.0

It may be accepted that the two upper grades (S + A) represent animals that have been well finished and that the majority of the animals of the two lower grades (B + C) could be improved in condition with further feeding. Slaughter at these grades represents a loss of potential meat. 28.3 per cent of steers, 48.0 per cent of bulls, 56.9 per cent of heifers, 74.5 per cent of cows and 80.5 per cent of cow heifers are graded in the two lower grades (B and C). As cow beef represents 47.0 per cent of the total beef slaughtered in this area (this, incidentally, is true for the country as a whole) the fact that three-quarters of these animals are graded in the lower grades means a substantial loss of potential beef.

It will be seen from the above table that there is a greater percentage loss in carcase weight in the female animals in the lower grades than in the males. There are certain obvious difficulties in the way of attaining similar weights amongst all the female animals because of the introduction of new breeds in increasing numbers, for example the Ayrshire and Friesian.

The majority of the animals described as cows and cow heifers are animals which, having calved in the spring, have been milked throughout the summer and for a variety of reasons are sold in the autumn. The pastures available in the late summer and autumn are not good enough to fatten these animals, neither is there sufficient food of the right quality available to fatten them during the winter or carry them over in good condition until the following spring. These cows and cow heifers represent the wastage in dairy herds in the region and, of the total, cow heifers are equivalent to 14 per cent. The fact that they are discarded after one lactation and slaughtered when in relatively poor condition (80.5 per cent are graded B or C) means considerable wasted effort and a potential loss of beef. They would have served a more useful purpose and provided more meat if they had not entered milking herds.

The average difference in weight between steers and heifers is nearly 2 cwts. and since a higher proportion of females than males are nowadays reared and slaughtered this again represents a considerable loss of potential meat. The operation of the calf subsidy scheme should correct this fallacy implicit in the war-time prooprtions of heifer to steer calves reared

Cow beef constitutes a high proportion of the home produced beef supplies (45 to 50 per cent). It should therefore be of good quality since Callow[8] has shown that well-finished cow beef is practically indistinguishable from mature steer beef. A readjustment of the relative price levels of cow beef and milk

TABLE 2

The contribution of the ungraded cattle (West Wales) 1943-48.

Category	Total Numbers Graded	Ungraded	Total	% Ungraded	Distribution of the ungraded Rejects	Casualties	Condemned
Bulls ...	5,212	1,473	6,685	22.0	314	1,115	44
Steers ...	34,937	849	35,786	2.4	49	755	45
Cows ...	35,758	20,857	56,615	36.8	13,294	3,275	4,288
Cow Heifers	5,885	761	6,646	11.4	221	508	32
Heifers ...	41,316	1,760	43,076	4.1	146	1,478	136
Totals ...	123,108	25,700	148,808	7.2	—	—	—

would have a highly beneficial influence on the supply. All that need be said now, is that the condition of the animals when slaughtered represents a loss of potential meat.

The Ungraded Cattle

In addition to those graded and accepted on the hoof at the Collecting Centres a considerable number of cattle, not suitable for grading, are accepted on a carcase weight basis. These are described in the returns as " rejects and casualties " and of both these classes a certain number of carcases are condemned as unfit for human consumption.

The actual figures for the six-year period 1943-48 are shown in Table 2.

The slaughtering of these cattle is an attempt to salvage what would otherwise be lost. The proportions are relatively small except that the ungraded cows and bulls contribute over one-third and over one-fifth respectively of the total deliveries. Probably many of the cows are aged and worn out, others are of the extreme dairy type which cannot readily be fattened; a proportion have suffered aliments or accidents, but, of the remainder, many could be fleshed up considerably by a summer's grazing on the rough pastures of the upland areas. Especially is this true of those animals of the dual-purpose type.

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The distribution of the ungraded cattle shown in Table 3 indicates that apart from the cows, the greater proportion are casualties. Nearly two-thirds of the ungraded cows are rejects and one-fifth of them are condemned after slaughter. There is also a fairly high proportion of rejects in the bulls and cow heifers but the proportion of rejects is low among steers and heifers. The table shows that the average carcase weights of the rejects and condemned are very similar and, as expected, the average carcase weight of the casualty animals is considerably more than that of the rejects and condemned.

The proportion of the cattle population sold for slaughter

The data from the Collecting Centres do not give an estimate of the total cattle sales because of the alternative disposals of the store and breeding stock. The Ministry of Food on the average purchase about 25,000 animals every year out of a population of about 300,000 (cattle and calves) head of stock in this

TABLE 3

The distribution and average carcase weights of the ungraded cattle.

Category	% distribution			Average Carcase Weights (lb.)		
	Rejects	Casualties	Condemned	Rejects	Casualties	Condemned
Bulls	21.3	75.7	3.0	545.1	614.5	556.0
Steers ...	5.8	89.0	5.2	366.7	468.1	371.1
Cows ...	63.7	15.7	20.6	389.2	449.0	377.3
Cow Heifers ...	29.0	66.8	4.2	346.8	431.6	308.8
Heifers ...	8.3	84.0	7.7	288.4	363.9	286.2

region, that is, about 8 per cent. The total disposals and deaths during this period (1943-48) are equivalent to the proportion of the under one-year-olds (number reared) to the total population (June 4); this represents a figure of nearly 20 per cent. In other words the sample through the Collecting Centres is 40 per cent of the average disposals each year and makes a very satisfactory sample for the purpose of this study. The remaining 60 per cent consists of the sales of store cattle, in-calf heifers, cows in milk, barrens and the sales of other stock, as well as of deaths. In addition, a small number of cattle are imported into the region.

The annual intake of in-calf heifers into the regional herds has been shown by Phillips[9] to be 25-27 per cent of the cow population and this is therefore an approximate estimate of the wastage out of the herds. The average cow population of 140,000 (cows and heifers in milk and in calf) in this region therefore suffers an annual wastage of approximately 35,000. It is known that 12,000 or nearly 30 per cent of that total pass through the Collecting Centres.

Howell[10] has shown that the total deaths of cows in dairy herds amount to about 1 per cent of the cow population whilst those becoming "screws" also come to nearly 1 per cent. In other words, the complete wrecks in the cow population in this region amount annually to 2,800 animals (2 per cent of the 140,000 cow population).

Seasonal condition of farm animals

It has been shown, Fig. 2, that the beef produced within the area is a grassland product. Similarly, the area is dominated by summer milk production. Growth in farm animals in the area is most marked in the summer; it practically ceases during the winter and early spring months when, in fact ,a large proportion of the animals loses weight.

Average live weights of young heifers and of a whole herd shown in Table 4 are typical of the loss in weight during the winter period.

TABLE 4

Summer gains and winter losses in cattle.

Average weight of dairy cows				Average weights of young heifers			
Period	Av. Wt. in April	Av. Wt. in Nov.	Average Summer gains	Date	Av. Live Wt.	Gains lb. Winter	Gains lb. Summer
1926-32	1084.1	1222.4	138.3 lb.	Oct. 1927	428	—	—
				Mar. 1928	493	65	—
	Av. Wt. in Nov.	Av. Wt. in April	Average Winter loss	Oct. 1928	722	—	229
				Mar. 1929	769	47	—
				Oct. 1929	981	—	212
1928-32	1184.7	1144.0	40.7 lb.	Mar. 1930	943	—38	—
				Totals ...	—	74	441

In the section relating to the cows in Table 4 it should be explained that the same group of cows is compared for each consecutive six monthly period, thus the same 20 cows are in April 1929, as in November 1929, and similarly the same cows for November and the following April.

In the case of the heifers, the live weights of a group of young heifers are compared throughout the years and the table shows that the total gain during three winter periods was only 74 lbs., whilst the increase during two summers was 441 lbs. During the winter 1929-30 the heifers were wintered out of doors.

This loss of condition means that for a part of the year farm animals are drawing on their body reserves of fat and muscle for maintenance. Part of the following summer grazing period is spent in making up for the loss in weight of the previous winter; the final weight attained is less than it would have been if the animal had progressed regularly from birth. This is one reason why the fat steers and heifers when killed at $2\frac{1}{2}$-$2\frac{3}{4}$ years (1,000 days) do not show an average of more than 1 lb. increase in daily gain during life, although capable of nearly double that amount. Over the whole country this loss in condition, or at best the period of least gain, is the most important single item of loss in production because it is of such general occurrence. After a bad harvest or a particularly severe winter (1947) the results are far greater than in a normal year.

Knackery Records

After this brief review of seasonal variations in the physical condition of

farm animals it is interesting to turn to an examination of knackery records. Knackeries are enterprises which endeavour to utilise in various ways wastages and losses occurring in farm livestock. A proportion of the meat so salvaged is used for the purpose of cats' and dogs' meat whilst the remainder is converted into manure products. The bones are processed for the fat and glue as well as for bone manures, whilst the hides enter tan-yards. In addition to these valuable functions the knackerieas collect live and dead animals from the farms, making a nominal payment for the same, so relieving the farmer of the laborious and expensive operation of burial. The commercial knackeries may operate up to a radius of 20 or 30 miles. In addition to the knackeries in the area a number of kennels draw their supplies of food from the animals dying locally.

TABLE 5

Details of the intake into four knackeries.

Knackery		Cows	Other Cattle	Horses	Other animals	Total
Lampeter	Jan., 1942—Dec., 1945	1,705	316	1,070	25	3,116
Cardigan	July, 1942—June, 1947	1,683	419	742	—	2,864
Carmarthen	Mar., 1942—June, 1943	1,023	110	460	—	1,593
Guilsfield	Mar., 1943—Sept., 1945	2,678	1,527	942	156	5,303

The records of the daily intake for some of the knackeries in this region have been analysed and acknowledgment is made to the owners for permission to carry out these examinations. Usually the knackeries are not concerned with carcases of the smaller animals such as pigs, sheep and calves unless there happens to be a number to be collected together, *e.g.,* a number of sheep killed by lightning. They confine their intake to cattle (cows, bulls, steers and yearlings) and horses and certain particulars are usually made against each entry, such as date, origin, sex. age, category (cow, bull, etc.) and in many instances the cause of death is given in so far as the experienced slaughterman is able to make a diagnosis.

The records of three knackeries within the region and one from the border country of Wales have been examined and the following brief account gives the more important facts derivel from them.

Table 5 gives particulars of the period, number and type of intake into the four knackeries.

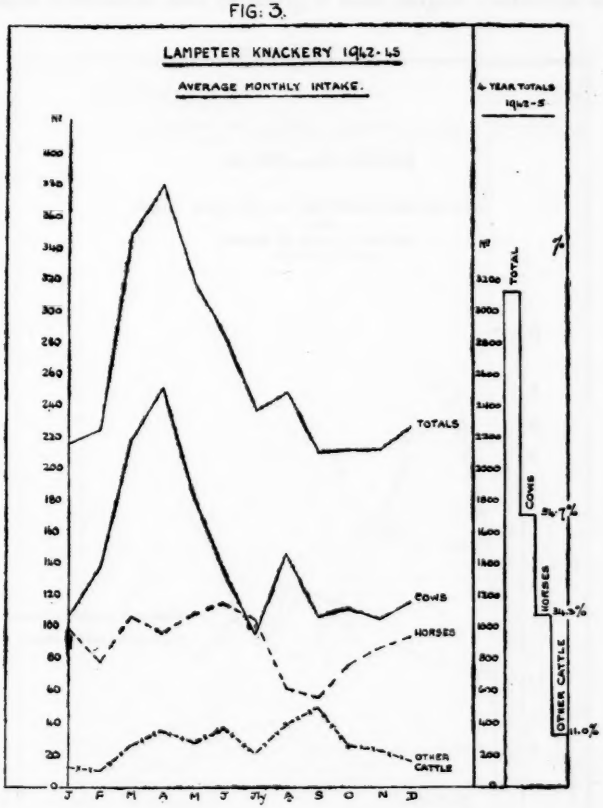
A total intake of nearly 13,000 animals is represented in this analysis but it is not possible to relate these to any population figures with any degree of certainty. However, some interesting facts relating to the distribution of the knackery intake have been revealed.

Lampeter Knackery

The records of this knackery over four years have been examined. Figure 3 shows that during these four years 3,116 animals entered this knackery, *i.e.,* about 800 per year, of which one-third were alive.

It is seen that 54.7 per cent of the intake consists of cows, 34.3 per cent horses and 11.0 per cent other cattle. In relation to the population figures for Cardiganshire (June 4 returns 1943) the above proportions indicate relatively higher losses in horses than in cows since the horse population is only 17.3 per cent of that of the total cattle (excluding calves) and horses. The seasonality

FIG: 3.



curves are interesting. The total figure and that for the cows are very similar showing a sharp build up from January to an April peak and then a decline to July. The cows also show a secondary August peak (probably due to summer mastitis in the dry cows at this time) and subsequently a fairly level monthly figure. In the horses the peak months are from March to July reaching the lowest levels in August and September and thence a gradual build-up. The other cattle (11.0 per cent of total) are relatively few, but show the highest intake in September.

Figure 4 gives the seasonality of the cow intake into this knackery together with the monthly sales of calves for the region as a whole. It is remarkable how close the two curves run together. Peak calf sales and peak calvings occur

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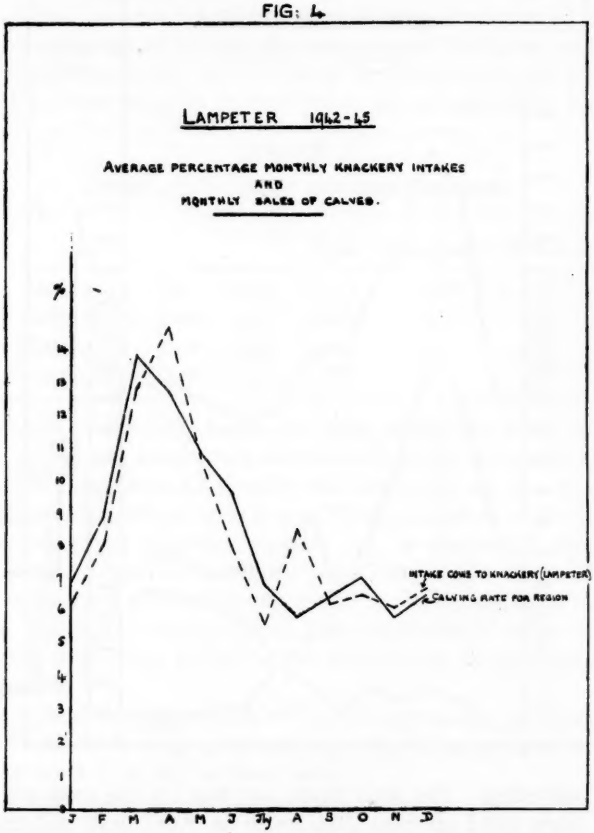
in March with a secondary peak in October. The peak intake of cows into the knackeries occur in April with a secondary one in August. The calf sale curves have been checked against milk sales (Phillips and Davies)[11] and against calf birth (Phillips).[7] The April peak intake corresponds to parturition risks and to the low level of the winter diet, the effects of which are apparent by April. The secondary August peak is probably due to summer mastitis.

FIG: 4.


LAMPETER 1942-45
AVERAGE PERCENTAGE MONTHLY KNACKERY INTAKES
AND
MONTHLY SALES OF CALVES.
%
INTAKE COWS TO KNACKERY (LAMPETER)
% CALVING RATE FOR REGION
J F M A M J J A S O N D

Cardigan Knackery

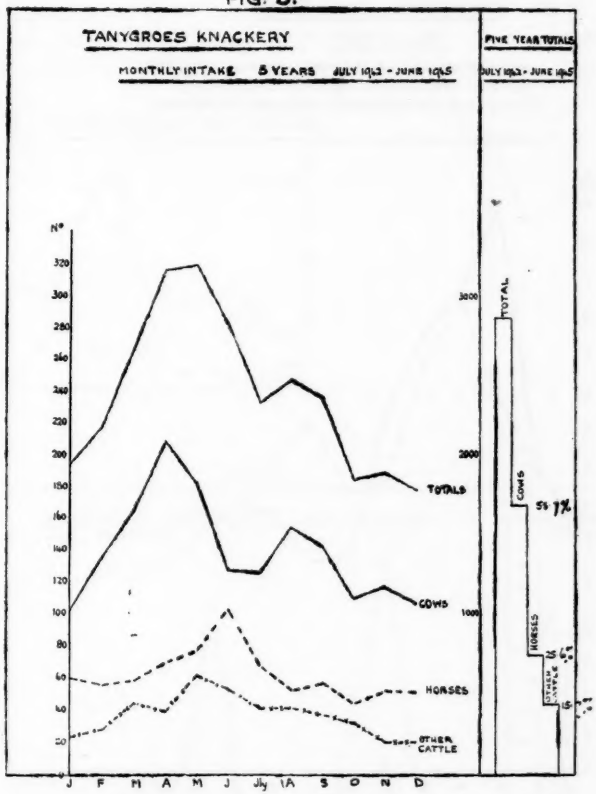
Figure 5 gives the proportions of cows, other cattle and horses and the seasonality of the intake.

There is a marked similarity between Figure 5 and Figure 3 (Lampeter). The proportions are similar (cows 58.7 per cent, horses 25.6 per cent and other cattle 15.7 per cent) and the seasonality curves are alike with an April peak and a secondary August peak for cows. Winter nutritional deficiences and calving risks are responsible for the May peak for other cattle whilst the June

peak for horses is probably due to grass sickness which was known to be prevalent in this area.

Figure 6 compares the percentage monthly intake of cows into this knackery with the average percentage monthly calf sales in four of the adjoining Collecting Centres (Cardigan, Crymmych, Newcastle Emlyn and Llandyssul) for the same period.

FIG: 5.



March peak in calf sales coincides with an April peak to the knackery. A secondary August peak coincides with summer mastitis in dry cows as shown by the secondary October peak in calvings.

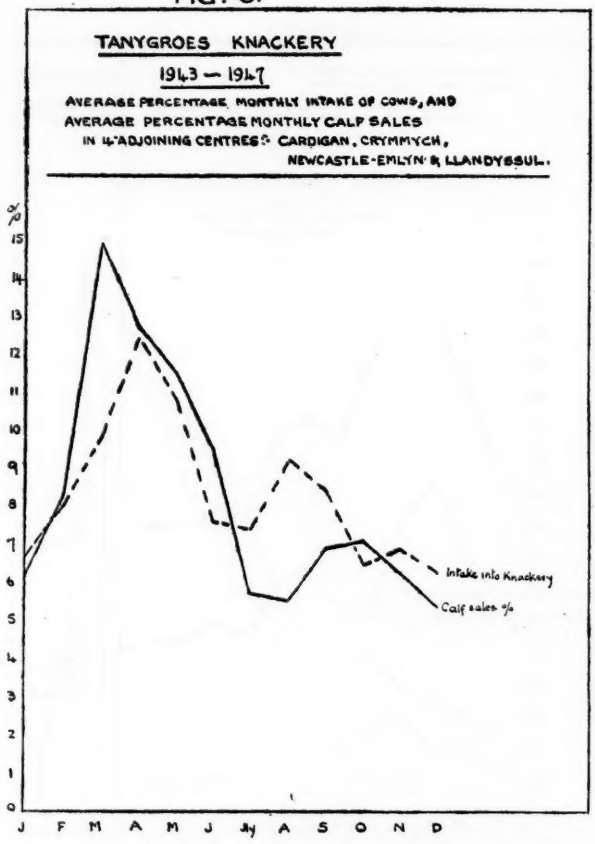
Carmarthen Knackery

Figure 7 illustrates the trends in this knackery.

The proportions of the three categories are similar to the previous cases although the intake of cows is much higher, and the other cattle lower. It should be remembered that there is a considerably lower proportion of other cattle to cows in the population (June 4) than in the other areas examined.

The monthly intake, Figure 8a, shows the same trends as in the other two knackeries of this region, although the peak intake is now a month earlier (March) for the total as well as for the cows. There is also a secondary August peak in cows coinciding with the incidence of summer mastitis. The high mid-

FIG: 6.



summer intake of horses (June, July) is a reflection of grass sickness and other causes. The May peak in the intake of other cattle follow the trends as in the other two knackeries. The comparative curves for the intake of cows and of calvings, Figure 8b, are unlike the previous two.

The peak of intake occurs in March with a secondary August one, but the peak in calf sales occur in April with only a very minor October peak. Phillips and Davies[11] have shown that the rate af autumn calving in this area was particularly low for the period 1943-46.

FIG: 8A FIG: 8B FIG: 7

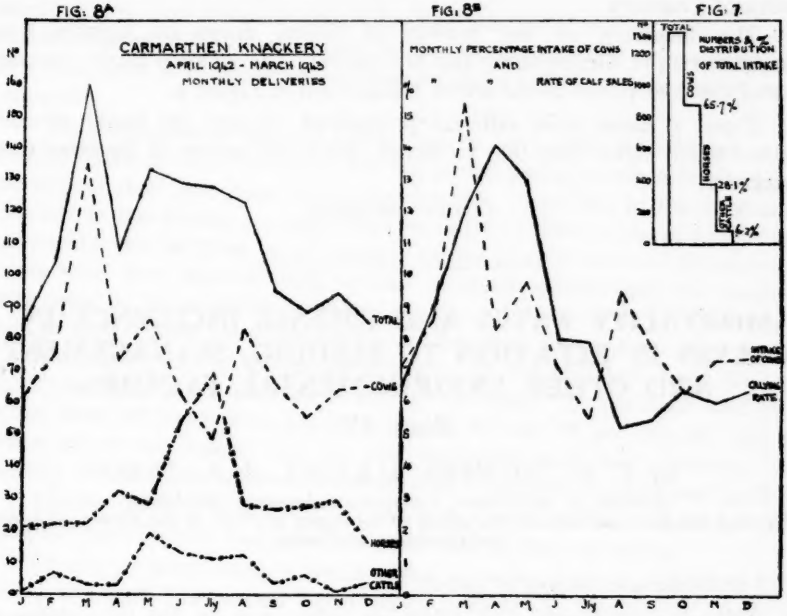
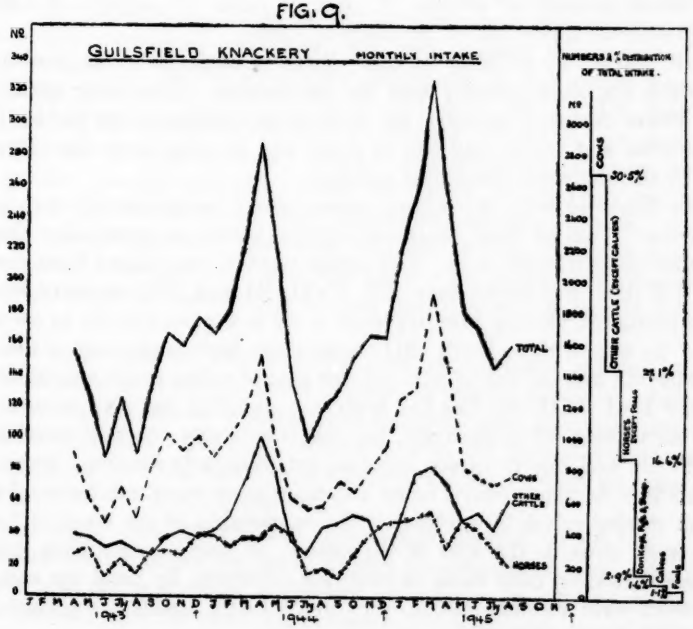


FIG: 9.



Guilsfield Knackery

This knackery, on the borders of Wales, draws its supplies from Montgomeryshire, Denbighshire and Shropshire. The monthly intake, covering part of the same period as the others, is illustrated in Figure 9.

Figure 9 shows quite different proportions, because the intake of other cattle is much higher than that for horses; this is the reverse of the other three knackeries.

(To be concluded)

MORTALITY RATES AND DISEASE INCIDENCE IN CALVES IN RELATION TO FEEDING, MANAGEMENT AND OTHER ENVIRONMENTAL FACTORS

Part IV

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10. *The subsequent feeding of calves.*

Following the ingestion of colostrum, calves may be fed by suckling or "on the bucket." In beef herds it is the practice to rear them on their own dams, either suckling *ad libitum* at grass or under the system of controlled suckling twice or thrice daily if in boxes or yards.

Calf rearing by suckling in dairy herds is confined to the use of nurse cows which are often specially kept for the purpose. One nurse usually rears several calves during a lactation, the number depending on her yield. During summer cows and calves may run at grass, and at other times the calves may be fed by the method of controlled suckling.

Five dairy herds in the present survey reared calves wholly or mainly on nurse cows. Two of these continued feeding calves on gruel after they had suckled for three months or so. The others weaned them direct from the nurse cows. Of these five herds, four (CI, CVII, BI and BII) recorded very low rates of mortality, varying from no losses at all to 4.4 per cent up to six months of age. In one of these herds (BII) nurse cows have reared up to five calves each, with the over-all loss of only 3.6 per cent of calves to six months old. In the other herd (LIII) the loss has been 7.2 and 16.2 per cent to one month and to six months old respectively, but this was largely confined to calves over a month old and due to causes unconnected with early feeding. None of the dairy herds in Scotland reared heifer calves on nurse cows. A factor of importance in rearing calves by suckling is the relationship of the stage of lactation of the nurse cows to the ages of the calves. If very young calves that have just ceased suckling their dams or receiving colostrum by hand are suckled on cows which have recently calved, very much better results are obtained than

when cows in later lactation are used. The practice of rearing calves on cows which are being dried-off or affected with mastitis is strongly to be discouraged. In small herds it is admittedly difficult to make suitable arrangements on all occasions.

The commonest method of calf rearing in dairy herds is by bucket or pail feeding. Here it is worth noting that the period during which calves are given the milk of their own dams varies considerably. According to the information collected in this inquiry it ranges from two days to three weeks or more. It is noteworthy that in those herds where a special point is made of giving young calves their own mothers' milk or that of freshly-calved cows the mortality rates were in the majority of cases very low. Of six herds in which dam's milk or that of fresh cows was fed for not less than three weeks, only one had a calf mortality rate exceeding the average. In five (LI, LoI, LoII, CV and BaIII) the rates varied from nil to 5.0 per cent only. In the other herd (RII) it rose from nil in 1946 to 5.9 in 1947 and to over 18 per cent in 1948 for calves up ot one month old, but this was concurrent with a change from suckling colostrum in 1946 to bucket feeding from birth in 1947 and 1948.

Nearly all the dairy herds fed calves for at least three weeks on whole milk, but periods from four days to several months were recorded.

Of the 30 dairy herds in which calves were pail fed, six (AI, AVI, LIV, LoIV, CV and RII) reared heifer calves entirely on whole milk, using no substitutes for calf meals at all. The ages to which milk was fed in these herds ranged from six weeks to six months. Four herds (BaI, NII, NVI and BIII) changed their methods of feeding during the three years, two which previously fed milk only introduced substitutes, and two adopted the opposite course. Twenty herds used various proprietary substitutes or calf meals during the whole period of the survey (AII, AIV, EI, EII, EIV, EV, LI, LV, LoI, LoII, LoIII, CIII, CVI, BaIII, NI, NIV, BIV, BV, RI and RIII). In these herds substitutes were introduced at an average age of about six weeks, but this varied greatly. In one herd (EV) it was the custom during 1946 and 1947 to add National Calf Starter to the milk when calves were four days old, gradually increasing the amount until gruel only was fed at nine weeks of age. This was discontinued in 1948 and milk was fed for six weeks before introducing gruel. The longest period of milk feeding before gruel was started was three months.

There is no evidence that mortality rates are adversely affected by using various milk substitutes and gruels as opposed to rearing calves on whole milk. An almost equal proportion of herds with mortality rates above the average is found in both groups, and of the two herds with the highest mortalities, one fed milk entirely and the other used substitutes. Each group contains herds with excellent records for low mortality.

It is evident that considerable economy is effected by the use of milk powders and meals, judged by the difference between the market price of the milk saved and the cost of the equivalent substitute. In view of the current demand for milk and the need for economy the reasonable use of substitutes

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is fully justified. It is, however, suggested that calves should receive whole milk until they are at least four weeks old. Calf rearing should be regarded largely as a capital investment, as the heifer calves of to-day will form the dairy herd a few years hence. Current saving at the expense of a sound future stock is obviously false economy. Poor condition due to under-nutrition or sickness in the early stages cannot be made good later.

Three points appear to be important in using milk substitutes and meals as gruel. The first is with regard to mixing. This is often carelessly done, resulting in a lumpy, uneven fluid which is unpalatable and harmful. The mixing of these substances to an even consistency is a matter of care. Secondly, the *gradual* introduction of changes in the diet is essential. At first small amounts should be mixed with the milk, slowly increasing the quantity and reducing the milk until the required ratio is reached or the milk eliminated, as the case may be. The complete change from milk to gruel should occupy not less than three weeks. Thirdly, the temperature of the feed should be as near body-heat as possible, and the finger is not a reliable or hygienic means of testing it. Much of the nutritional scours and other ailments of calves are undoubtedly due to neglect of these points.

In the herds in which calves are pail fed there is a widespread practice of giving four pints of milk twice daily. In a few herds less was fed and in some the practice is adopted of feeding diluted milk in the proportion of three parts of milk to one of water. In two herds (LIV and CV) it has been the custom to weigh the milk and to feed 5 or 6 lb. twice daily. It does not seem to be a common practice to increase the quantity of milk fed as the calf grows, reliance being placed on the gradual introduction of dry feed to satisfy increasing demands or of increasing the volume of liquid food only after milk substitutes or gruel are started. In only five herds (EI, NIV, BIII, RI and RIII) was it stated that calves were fed three times daily during the early stages, the amounts varying from two to three pints per feed. It would seem that more feeds than two in 24 hours would be advantageous, at any rate for the first week or two. Under natural conditions at least six feeds during 24 hours are probably taken by suckling, with an intake of perhaps one and a half pints on each occasion. The difference between this and the feeding of four pints twice daily is very marked and must be responsible for much digestive disturbance. The very long interval between the afternoon or evening feed and that of the following morning is also a bad feature of this system. Labour is probably the controlling factor, and for this reason calves are more likely to be fed more frequently, and greater care given to the small details which are so important, in the smaller herds.

In some herds water is withheld until calves are entirely on dry feeding; in others access to water is allowed from birth. There are approximately equal numbers of herds in these groups and it does not appear to make any difference to the result so far as mortality rates are concerned. There seems to be no reason why water should be withheld. It is more rational to allow calves to drink water as desired, relying on their instinct. If water is not available there must be occasions, especially in warm weather and during the long

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interval between feeds, when its absence is a disadvantage. As already stated, some feed diluted milk to calves. This is based on the belief that it prevents scours. Even in the Channel Islands breeds, however, where some dilution of the milk is probably desirable, there are experienced stockmen who advocate the feeding of whole milk and free access to water to drink from birth.

The early feeding of calves and the digestive disorders resulting from irrational methods have been described by Sheehy (1934, 1948). He attributes nutritional scours to abnormal curd formation in the fourth stomach and points out that the custom of pail-feeding twice daily and giving the milk of cows in late lactation and mixed or stale milk are contributory factors. If the resulting dense clot is not digested before the following feed the action is cumulative, with consequent irritation of the mucous membrane. In marked contrast is the soft, easily-digested curd of colostrum or early lactation milk, with their much higher globulin content. He advocates the treatment of such disorders by the feeding of warm water followed by diluted milk, but their avoidance is obviously preferable. This can be achieved by feeding young calves three or more times daily on their mothers' milk or that of freshly-calved cows for the first two or three weeks. The susceptibility to infection of calves weakened by early digestive troubles is stressed.

Dry feeding.

In 12 of the dairy herds (AIV, CVII, NII, NIV, NVI, BI, BII, BIII, BV, RI, RII and RIII) hay was allowed to calves from birth or a few days old. In the others it was introduced at various ages, the average being about a fortnight. Concentrates in the form of calf-nuts, cakelets or bran were given at a few days old in four herds (BI, BII, BIV and RIII), but the average age for introducing concentrates was about four weeks, and it was delayed in some herds until three months. There does not seem to be any correlation between the mortality experienced and these different practices. In a number of herds where the calf mortality has been very low those responsible for rearing strongly advocate the introduction of hay and concentrates in the form of calf cakelets or rearing nuts almost from birth. They maintain that if small quantities are available calves soon take dry food eagerly and that this reduces the digestive troubles associated with keeping them on a liquid diet for several weeks. Similarly, some feed meal mixtures dry at an early age instead of making them up in liquid form. This serves the same purpose and avoids the necessity of making gruel. It seems probable that this is sound and that the early introduction of dry feeding hastens the development of the digestive tract and so helps to get the calf more rapidly beyond the stage of early ailments.

In the dairy herds in the present survey the average age up to which calves are receiving liquid food (i.e., milk, milk substitute or gruel, or a mixture of milk and gruel) is 16 weeks. This varies from a minimum of eight weeks to nine months, but this maximum is in one herd only where calves are on milk for three months and then receive calf meal fed as gruel up to nine months old.

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Most of the herds used calf-nuts, cakelets or bran at the commencement of dry feeding but soon changed to home-grown feeding stuffs with mineral addition which were in some cases supplemented by purchased foods. Favourite constituents of the meal mixtures used were crushed or rolled oats, linseed cake, flaked maize, bran and fish meal. Beans and tail barley were also used and, at farms where grass-drying is the practice, dried grass meal. In some herds cod-liver oil is incorporated in the calf feed. It is common practice gradually to increase the dry feed so that calves receive 2 to 2½ lb. of concentrates at three months old, and as a rule this ration is gradually doubled by the age of six months.

Practice with regard to turning calves out to pasture varied considerably. Whilst largely dependent on local conditions, there is also much difference of opinion. Some breeders favour early grazing and calves born in the autumn and winter may be at grass by day in the following spring, and day and night in the summer when only a few months old, receiving a supplementary ration of concentrates at first but no extra feed later. In other herds calves born from October onwards were kept indoors for a year or more, the younger ones not even going out by day during their first summer. These are extreme cases, but there is a tendency in some herds to work to arbitrary rule in this respect. Exercise at pasture by young stock in good weather cannot be other than beneficial.

The subject of calf nutrition was exhaustively reviewed by Savage and McCay (1942). They deal with the available information up to that time concerning the nutritional requirements of calves and the feeding stuffs and milk substitutes in use. Tables of standard weights of calves of different breeds are given up to 16 weeks of age. There is an extensive bibliography, mainly of the American literature on the subject.

11. *Housing and hygiene.*

These environmental factors are likely to have a greater influence on mortality and the general well-being of calves in dairy herds than in beef and dual-purpose herds. In the beef herds the standards of housing and hygiene are fairly uniform and generally good, and the animals are usually in yards or at pasture. In the smaller dual-purpose type of herd the standards are often low, but in spite of this calf losses are rarely high. The more natural methods of management probably compensate for shortcomings in accommodation and cleanliness.

In the dairy herds, where calves are housed and most are artificially fed, these factors probably play a more important part. Warm, dry quarters which are well ventilated and lighted but free from draughts, sufficient bedding which is frequently changed, facilities for isolating sick animals, and cleanliness of the feeding utensils are conditions essential for the rearing of calves with minimum losses, but in very few herds are they all given the attention they merit. The provision of individual calf pens, for example, is exceptional and was only found in five dairy herds of the present series.

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The standards of housing and hygiene in the different herds generally follow one another closely but are not necessarily identical. In some cases buildings are old and badly designed but great attention is paid to cleanliness. In others the hygiene is inferior to the standard of accommodation. These two factors are not easy to assess precisely but the relative standards are of more importance for the present purpose. In the dairy herds they have been described as "excellent," "good," "moderate," "poor" or "bad," and the herds have been arranged on this basis in Table 24. The mortality rates to one month and to six months of age for the three-year period are also given.

TABLE 24

Dairy herds: assessment of housing and hygiene in individual herds, and heifer calf mortality rates to one and six months.

Herd	Housing	Hygiene	Mortality rates to one month per cent	Mortality rates to six months per cent
EIV	Excellent modern buildings ...	Excellent	3.1	5.8
LI	Excellent; separate pens; artificial heating	Excellent	2.4	3.8
AII	Excellent modern buildings ...	Good	2.6	3.4
BaIII	Good; buildings mostly old but good repair with modern loose-boxes	Excellent	nil	1.4
CVII	Good; modern calf house ...	Excellent	nil	4.4
BI	Good; buildings old but in good repair	Excellent	nil	nil
AI	Good	Good	8.9	13.3
LoI	Good; modern	Good	3.8	3.8
LoIV	Good; modern with separate pens	Good	2.3	6.8
CVI	Good but limited	Good	nil	5.3
NII	Good	Good	6.4	7.4
NVI	Good; old but good repair; separate boxes for young calves	Good	6.3	6.9
BII	Good and well arranged	Good	1.8	3.6
BIII	Good; modern stone buildings ...	Good	11.8	16.5
RIII	Good; much improved in 1947 and separate pens provided ...	Good	7.8	10.8
CIII	Good	Good	1.6	2.4
LoII	Moderate; old but satisfactory ...	Good	7.7	7.7
RI	Moderate	Good	7.7	9.9
LIV	Moderate; old but in fair condition	Good	4.0	4.0
CV	Good; old but in fair condition ...	Moderate	3.1	3.1
RII	Good; separate pens	Moderate	8.7	13.0
AIV	Good	Moderate	4.3	6.0

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TABLE 24—*continued*

Herd	Housing	Hygiene	Mortality rates to one month per cent	Mortality rates to six months per cent
EI	Moderate; makeshift	Moderate	6.4	7.7
EV	Moderate	Moderate	2.1	5.2
LIII	Moderate generally but different buildings vary	Moderate	7.2	16.2
LoIII	Moderate; makeshift	Moderate	11.5	13.1
CI	Moderate but very limited ...	Moderate	2.0	2.0
BaI	Moderate; makeshift	Moderate	5.8	5.8
NI	Poor but there are some separate pens	Moderate	1.6	3.2
NIV	Poor; old buildings poor condition	Moderate	3.8	5.1
EII	Moderate, but young calves in one house together	Poor	21.1	24.3
BIV	Makeshift; poor	Moderate	5.4	8.9
LV	Poor; bad overcrowding; ill-lighted and ventilated	Poor	1.0	4.8
BV	Bad; badly drained and ventilated	Poor	1.6	1.6
AVI	Poor; old buildings badly arranged	Bad	20.1	22.4
		Average mortality	6.2	8.3

The first six herds on the list with the highest standards of housing and hygiene are exemplary for their calf mortality records. In the next ten herds, in which both housing and hygiene are good, there are three (AI, BIII and RIII) with excessive rates of mortality. Of the following twelve, with at least moderate standards of housing and hygiene, three herds (RII, LIII and LoIII) have had high calf losses and there is one (RI) with rates somewhat above the average. The remaining seven herds constitute the lowest group for housing and hygienic standards and include the two herds with the worst calf mortality records, one with a rate slightly above the average (BIV), and another (LV) in which the calves have been in poor condition although the mortality rates are low.

It appears that housing and hygiene are among the numerous factors that exert an influence on calf mortality and health although their effect may sometimes be obscured.

12. *The personal factor in management.*

The fundamental importance of the personal factor in the rearing of calves is unlikely to be disputed. Efficient management and personal care and attention to detail are basic requisites for success in any branch of animal husbandry. An efficient person will not tolerate bad conditions and the personal factor is therefore the controlling one.

It has already been remarked that calf rearing should rightly be regarded as a capital investment. It is therefore remarkable that in some dairy farms it appears to be a sideline and often the part-time occupation of an employee

whose other duties leave little time for the proper care of calves. The result is the frequent delegation of the work to casual and inexperienced labour with makeshift facilities and lack of personal interest.

Calves were probably never better cared for than in former times by the farmer's wife and daughters. This homely method is still practised at some farms where the numbers are small and almost invariably with excellent results. Perhaps the best system in large modern dairy herds is for a woman or girl to take charge of the calf rearing and also to keep the herd records. A suitable person with a liking for the work finds it a satisfying occupation and takes a pride in the results. It is not a suitable task for a man whose principal duty is the general management of a dairy herd with the considerable work involved in rationing and milking. He has not the time to devote personal attention to it.

It is most important that frequent changes of personnel should be avoided. Even when the methods of feeding and management are laid down by the owner changes of staff invariably involve some differences in application and detail which are inimical to success. The hand-rearing of calves involves not only intimate knowledge and experience but application, and these qualities cannot be expected of anyone who lacks continuity of interest. For example, only the person who actually feeds the calves knows whether they receive colostrum and the correct quantities of food at the right temperature in clean vessels. Unless this person is thoroughly reliable it is necessary for success that the owner or manager be present to see that these details are attended to. There is no doubt that a great deal of sickness is due to inattention to such matters and that where success is achieved it is in no small measure due to persistent and careful attention to them. This particularly applies when calves are removed from their dams at birth as in these circumstances the feeding of colostrum depends solely on the human factor.

It is noteworthy that a majority of the herds which have good mortality records feed colostrum naturally and in a majority of those with bad records it is fed by hand. In those herds where good results are obtained, although the artificial method is employed, a high standard of personal supervision is the rule.

Although a great deal has been achieved in the application of scientific principles to nutrition and the prevention of disease, animal husbandry is still primarily an art and is likely to remain so. The introduction of new drugs and biological preparations will not absolve farmers from the necessity of exercising the everyday care and trouble necessary for the successful rearing of animals. The information collected and experience gained in this investigation have amply confirmed that close attention to the many small details involved is the most important single factor in the successful rearing of calves.

13. *Subsidiary information on calf mortality and disease.*

Over twenty additional farms not included in the main investigation were visited during the course of this enquiry. They were situated in Kirkcudbrightshire, Devonshire, Cornwall, Shropshire and Lincolnshire, and give some indications of the calf mortality experienced and the methods of husbandry practised in those areas.

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Five dairy herds of Ayrshire cattle in Kirkcudbrightshire were visited on two or three occasions during 1947 and 1948. Twenty-five to fifty heifer calves a year are reared in each of these herds and it is the custom to remove them from the dams at birth and feed them by bucket. A few selected bull calves are suckled. All the owners stated that the calves were given the colostrum of their dams for a few days. Four of these herds had suffered heavy losses during the preceding few years. The 1944 and 1945 seasons seem to have been the worst; in two herds it was stated that 50 per cent and 75 per cent respectively of the heifer calves being reared in the spring of 1944 died. A third reported " heavy " losses in that year. There has been a gradual improvement in subsequent years. They all recorded the heaviest mortality in the spring months, especially February and March, and said they found no difficulty in rearing late summer and autumn calves. There were complicating factors in one of these herds. The farm is situated on the slopes of the Criffel mountain and the soil is cobalt-deficient. Some of the land had been dressed in connection with experiments on pining in sheep carried out by Dr. Stewart of the Animal Diseases Research Association. The cows in this herd suffered rather badly from acetonæmia. The owner stated that calves appeared normal for a few days and then died suddenly without any symptoms but a few were ailing and recovered. The losses occurred in March. An improvement from 50 per cent loss in 1944-45 to half this in 1947 and only 12 per cent in 1948 may have been related to the dressing of the soil. The calves at this farm also suffer badly from husk and the owner thought it was those which had been sick at an early age that were more susceptible to parasitic pneumonia later on. There was overcrowding of calves in old buildings at this farm and the hygiene was very bad. Nearly all the calves were suffering from ringworm. It is the custom here to turn calves out to grass day and night in the late spring or early summer when only a few months old. Some, kept in on veterinary advice, were not affected with husk. It is largely a matter of housing and labour. The losses in this herd in 1948 (about 12 per cent) were due partly to scours and partly to pneumonia; none were said to have died of the undiagnosed condition responsible for the heavy casualties a few years previously. In 1948 the calves were all inoculated with a proprietary anti-scour preparation.

In the herd which lost 75 per cent of the calves in 1944 it was stated that they did not thrive from the start. Some scoured and others did not. Some were found stretched out with stiff, rigid necks. In 1945 Dr. Stewart suggested giving cod-liver oil to the calves but losses continued heavy. In 1946, in view of the tetanic nature of the condition, he proposed magnesium-rich minerals in addition to cod-liver oil and this combination seems to have effected an improvement as in 1947 only 4 per cent died. The losses in 1948 were 10 per cent and many of these were moribund within 24 hours although they received vitamin A and colostrum by bucket soon after birth. A few of them scoured before death. Undoubtedly some of the deaths in this herd were due to *Bact. coli* septicæmia but there were probaly complicating factors.

The other two herds which have experienced serious losses also reported an

improvement since 1944-46 although in one they lost 30 per cent in the spring of 1947. The chief cause was pneumonia but the causal organism has not been identified. One of these farmers stated that he had tried calving the cows at grass and suckling calves but without effect on the losses. It is not known for how long this experiment was tried, but he went back to the usual method of removing calves at birth.

In the only herd of the five which had not suffered recent heavy loss the owner's previous experience had led him to arrange calvings as far as possible during the period October to Christmas. He thought the susceptibility to disease of spring-born calves was due to in-calf cattle being stall-fed during pregnancy. He had lost only four of 66 calves born in the 1947-48 season when most of the calvings were in autumn and early winter. There were no cases of scours or pneumonia and the few deaths were due to accidental causes.

These casual visits show that there is a great deal that needs investigation in connection with calf losses in this area. The enquiries confirm that there is serious loss in the spring months from white scours and pneumonia and from as yet undiagnosed conditions which may be due to deficiency factors and to various causes connected with methods of feeding and management.

Five herds were visited in Cornwall and six in Devon during 1948. Two of the latter were beef herds but the remaining nine were dairy herds. The breeds comprised Ayrshire (3), Friesian (3), Dairy Shorthorn and Guernsey (1 each), and a mixed Shorthorn and South Devon herd. The beef herds were Devons. The numbers of calves reared annually varied from about a dozen to 50 in the dairy herds and from 50 to 70 in the beef herds.

The custom in these counties is to suckle dairy calves for four days to a week on their dams and then feed them by bucket. Of the nine dairy herds only three took the calves away from the dams at birth. The beef herds practised the usual method of rearing by suckling. Losses are on the whole very light. Eight of the eleven reported only occasional losses and no serious outbreaks of disease among calves. Only in three were there more than slight casualties and these herds were in Devonshire. One, a Friesian herd, reported a few deaths due to scours up to 1947, but since vaccinating all the heifer calves as soon as possible after birth losses from this cause had ceased. One or two calves in this herd died of pneumonia in 1947 and 1948. The calves were suckled on their dams for five days before bucket feeding. The other herds in which losses were reported both fed colostrum by bucket. One was a herd of pedigree Friesians with a history of sickness commencing in 1947 when several calves were ill but none died. In the spring of 1948 five or six died and in the autumn one was sick and recovered. All these cases were similar: calves affected were one to three weeks old, there was accelerated breathing with coughing, inability to drink and temperatures of 105 to 106 deg. F. There was no scouring. The condition was diagnosed by the Veterinary Investigation Officer as *Salmonella dublin* infection. Several drugs were tried and the most effective was sulphamezathine. This has since been given to all the calves as a routine and the losses are subsiding. A few bull calves are reared for stock in this herd

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and the owner thinks that the losses among them were relatively heavier than in the heifers.

In the other herd (pedigree Ayrshire) the losses started in 1945-46 when ten out of 40 heifer calves died. It was diagnosed by the Veterinary Investigation Centre as *Pasteurella* infection. The owner then changed to rearing calves on nurse-cows and has continued this practice, but he still gives them colostrum by bucket and they are not suckled on the nurses until four days old. During 1947 and 1948 all the calves reared were given injections of serum prepared from the homologous strain of *Pasteurella*. The premises have been thoroughly disinfected since the outbreak started. The losses gradually abated and in 1948 none died and only one was sick. The serum injections were discontinued in the autumn of that year. This herd has also had cases of scours of the nutritional type but no deaths. These have occurred in calves bucket fed owing to insufficient nurse cows and at the change from dam's milk to bulk milk. Husk has also been prevalent in older calves, the pasture being very wet in places. Asked why he did not suckle calves on their dams for a few days this owner expressed the opinion that some cows will not let down their milk for a week or longer if they have suckled a calf. This is one of the reasons always advanced by Scottish Ayrshire breeders for removing calves at birth.

The Cornwall Agricultural Executive Committee's Calf Rearing Scheme was also inspected. Bull calves, mostly of the Devon, South Devon and Shorthorn breeds, are bought at markets at ages up to ten days old and reared on nurse cows. At one centre there were eight nurse cows, all reactors to the tuberculin test, from the Committees' dairy herds. Each cow rears four calves at a time, suckling them twice daily for five or six minutes for ten weeks. A cow will thus rear twelve or more calves per lactation. The calves get crushed oats and hay at two or three weeks old and later calf cake. Losses have been very small, only five deaths out of 350 reared during the three years commencing 1945-46, but most of them are beyond the chief period of risk when purchased. No trouble has been experienced with infective scours and very little with scours of the nutritional type. There is said to have been only one case of tuberculosis in a calf reared in this way, which is remarkable in view of the history of the nurse cows. The final product was seen in the form of a bunch of three-year-old steers which all graded well. They were reared entirely at grass since a year old. The scheme is a financial success and is designed to show that the average farmer in Cornwall could rear beef stores or fat steers at a profit in this way. Similar experiments are conducted by other County Committees.

Whilst visiting regular herds in Shropshire during the period of the survey a somewhat similar system under private management was seen in operation A small herd of ten to fifteen Shorthorn cows and a Hereford bull are kept. Large numbers of cross-bred calves (mostly Hereford-Shorthorn) are purchased at a few days old in batches and reared by suckling the herd cows for nine or ten weeks. Each cow suckles the same calves at the same quarters twice daily. After weaning the mainstay of the system is dry feeding on a milled mixture of home-grown produce very rapidly produced with little labour in a hammer mill.

At this farm 625 calves have been reared in the three and a half years from the beginning of 1946 at a stated loss of twelve calves or under 2 per cent. Again they are purchased at a few days old and the hazard prior to that age is avoided. Of the deaths a few were due to scours, some to *Pasteurella,* others to *Corynebacterium pyogenes* infection, and some to joint-ill, the cause of which was not diagnosed. Some of this infection was introduced with purchased calves which it is impossible to avoid under this system. The farm has been visited by representatives of one or two County Agricultural Executive Committees with a view of introducing calf rearing schemes on similar lines. There has been a number of cases of photosensitisation following the use of phenothiazine in six-month-old calves in this herd where husk has at times been prevalent.

That serious scours in calves of the beef breeds occur at times is illustrated by an outbreak in Lincolnshire in the spring of 1949. Six farms were visited in which Lincoln Red calves were being reared on their dams in yards or at grass. The outbreak started early in March affecting a number of herds over a fairly wide area. On each farm the disease persisted for periods up to several weeks. The calves attacked have been from one or two days old to as much as seven weeks. In the very young calves there was absence of clinical scouring. They were found stretched out, unable to suckle and with staring coats and sunken eyes, and rapidly died. In cases occurring at later ages there was diarrhœa with ejecta varying from a light-coloured fluid to firmer, yellowish or greyish material. Unfortunately no cases in these outbreaks were bacteriologically confirmed as *Bact. coli* infection, but the picture was typical *Bact. coli* septicæmia in the early cases and of white scours in others. This was the most serious outbreak in the area concerned for some years and the losses were heavy, ranging from about 10 per cent to two-thirds of the calves at risk. The septicæmic cases were rapidly fatal and others very refractory to treatment. Scour mixtures, recommended doses of proprietary sera, and drugs such as sulphapyridine failed to control the attacks. The only treatment at all effective was massive dosage of *Bact. coli* anti-serum accompanied by sulphathiazole, but in most herds the outbreaks appear eventually to have spent themselves, treatment being of very little use. Nearly all these herds were self-contained, in the sense that young calves were not bought in. In fact the only calves purchased at the time were replacements of those which died in the outbreak. It is very difficult to ascertain the origin of such a widespread epizootic.

(To be concluded)

CLINICAL ARTICLE

A CASE WHICH COULD BE CONFUSED WITH RABIES

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THE patient was an Egyptian born five-year-old bull terrier dog. It was quite well until March 6 when it stopped eating and became listless. There was evidence of abdominal pain and the dog kept eating grass and vomiting it up. On the morning of the third day he was given some buttered toast. This was vomited later and a large pebble was embedded in the toast. A mixture of castor oil and olive oil was administered and in the afternoon a glycerin enema was given. There was complete anorexia and the temperature registered 39.5° C.

On March 9 the castor oil and enema were repeated. That night there was severe abdominal pain. In the morning a pebble one inch long was expelled in some fæces. The dog continued to refuse food and the abdominal pain persisted. On the seventh night the pain was so great that a sedative was given in a little milk. This was vomited immediately. Next morning the eighth day, the dog passed some straw in which a piece of shrapnel was embedded. When examined his temperature was 39.8° C. and it was noticed that the larynx was very inflamed. The throat was swabbed with hydrogen peroxide. On March 14 the dog was presented for examination at the Veterinary School. It was suspected that he might be suffering from rabies and he was handled with caution. An X-ray examination revealed that there were three stones in the intestine. He was given a further dose of castor oil followed by a dose of liquid paraffin every six hours.

An X-ray examination on the 16th demonstrated that the foreign bodies had moved. There was some improvement in general condition and on March 18 he passed another pebble. From this time improvement was rapid. Appetite returned and the patient appeared to be normal. He ate ravenously of porridge, milk, minced meat and rice.

He was given more liquid paraffin at daily intervals. On the 20th X-ray examination was negative to foreign bodies and it was presumed that the other two foreign bodies had been passed unnoticed. On enquiry it was discovered that the owner was wont to exercise his dog by throwing stones which he retrieved showing great signs of excitement.

In countries where rabies is a frequent occurrence one is likely to jump to a conclusion precipitantly. It is also remarkable how even large foreign bodies may be expelled, given time and patience.

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ABSTRACT

THE DISTRIBUTION OF SNAIL POPULATIONS IN STEPPE AND MOUNTAIN. *The Proceedings of the Kazah Veterinary Institute for Scientific Research* Vol. III. Alma Ata, 1940.

IN Turkestan, as in other countries, the incidence of fluke infestation is a matter of outstanding importance to the sheep industry, and in 1936 Professor Tsvetkov carried out a survey of the distribution of the snail hosts of the parasites in the pasture in the region of Alma Ata. The following notes are taken from his paper, which appeared in the proceedings of the Kazahstan Veterinary Institute for 1940.

For the purpose of the survey the district was divided into the following belts: Desert steppe, dry steppe, meadow steppe, the subalpine region, the alpine region, and the region of snow. The height of the pastures above sea-level was considered a point of greatest importance.

The Desert Region. An area of small hills intersected by river valleys, water courses and gullies in which were beds of loess of some thickness. The average height above sea-level in this region was 600 to 900 metres, and the annual rainfall never exceeded 250 mm., and was often half that amount. The prevailing vegetation on the plain was *Artemisia sublessingiana* and *Artemisia terræ albæ* with patches of *Stipa splendens* in the hollows: in the river valleys the flora was more varied, and in addition to the *Stipa,* the bullrush and various types of meadow grass (*Hordeum secalinum, Agropyrum repens*) were to be found. These areas near the rivers were in many cases used as arable land by the local farmers. In many places salt pans were to be found on the plain, and here the plant *Sal-sola* flourished, while in others, where patches of pure sand prevailed, there was, in addition to the *Artemisia,* both *Eurotla ceratoides* and *Ceratorazpus areanarius.* Finally, along the river banks areas of sand were to be found (*tugai*) in which *Tamarix pallasii, Salix Halimodendron* and *Eleagnus* grew, and round these patches were wet bogs covered with bullrushes. This belt of desert steppe is of the greatest importance in that it provides the flocks and herds with the bulk of their spring pasture: from the point of view of snail population it falls to be considered under the following heads: The desert steppe proper, which is the basic pasture area; the hillocks; the river valleys; the salt pans; the *Stipa* beds; and the plough-land. After the most careful investigation, the first area, the steppe proper, was found to be without any snail population at all, and was therefore perfectly safe from a fluke point of view. Those parts of the hills which adjoin this desert, and which, like it, are covered with *Artimisia,* are also free from snails, but on the steeper slopes, where there are small rocks and where grass is mixed with the *Artimisia,* small colonies of *Cathaica semenowi* are to be found—none, however, were found alive, as this was in the autumn. In the river beds the molluscs were numerous and their distribution varied; stagnant pools yielded *Limnæa auricularia* and *Planorbis planorbis,* and the smaller pools *Planorbis planorbis* and *Planorbis gredleri* and *Limnæa truncatula,* the latter in many cases coming out of the

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water and inhabiting the wet banks. On the edges of the swamps and in the grass, *L. pervia* was to be found, and round the more or less permanent water holes, *L. truncatula, L. pervia, Succinia elegans* and *Agriolimax agrestis.* The *Succinia* preferred banks with a tall growth of vegetation and not the beds of rushes; this species has apparently a yearly cycle of development and dies off in the autumn.

The position with regard to the river beds may then be summarised as follows: In thickly-growing rushes no snails are to be found, nor are there any in the brackish areas, or those whose banks are without vegetation and which are covered with mud. Where the grass is thick and short, *Pupilla muscorum, Vallonia costata* and *V. pulchella* may be observed, while in places where the vegetation is varied and of average length we get *Fruticicola lantzi, F. rubens, Vallonia costata, V. pulchella, Agriolimax agrestis, Vertigo antivertigo,* and *Succinia elegans.*

Further to the above remarks on the snail population of the desert steppe may be added the following: That the beds of *Stipa splendens* always attract snails, and where these are to be found in the valleys large numbers of *F. lantzi* are always to be found in them. If, of course, the *Stipa* is growing on the dry ground among the *Artimisia,* then no snails are to be observed. On the newly-ploughed land no snails were caught, but in several-year leys, particularly of lucerne, and in the irrigation ditches, large numbers of *F. lantzi* and *F. rubens* were present. It may be that the infestation of the lucerne takes place in a spring migration, and that the snails die off during the heat of the summer—in the autumn only the empty shells of dead snails were to be found.

The Dry Steppe. A hilly area situated between 900 to 1,050 metres above sea-level with an annual rainfall of between 250 to 450 mm. The flora is intermediate, between that of the desert steppe and the next area, the meadow steppe; with the increase in height a number of grasses begin to appear among the *Artimisia,* such as *Festuca sulcata* and *Stipa capillata,* until, finally, we get *Astragalus, Oxytropes* and other plants, and the *Artimisia* finally disappears. Considerable areas of this dry steppe are ploughed up, but in the intervening places are deep valleys with *Stipa splendens,* rushes and meadow land, rock-strewn ravines and small salt pans. The plain proper is without a snail population. In the hilly parts, where these abut on to the desert, we have *Cathaica semenowi,* and, where the hills approach the mountains, *F. lantzi, Parachondrula secalina* and *P. aptycha.* Those parts of the area which are closest to the meadow steppe above harbour *F. rubens, Cathaica cœlestimontana* and *Ena asiatica.* In this region *Cathaica semenowi* is the true local inhabitant; the other species are migrants which die off, being unable to stand the dryness. The river valleys are, of course, the great reservoir of the snails, and in this region they come out more on to the river banks and plants in the neighbourhood of the water.

The Meadow Steppe. Situated 1,000 to 2,000 metres above sea-level and intersected with deep ravines and valleys; the earth is black and the flora is rich, since we find here *Festuca sulcata, Stipa capillata, Agropyrum repens, Dactylus glomerata, Bromus inermis, Bromus erectus,* Timothy grass, *Poa*

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bulbosa, Centaurea and *Umbelliferæ*. There are also apple trees, apricots, and the hawthorn.

The region is considered under the following headings: The steppe, where *C. semenowi* is the commonest snail, with here and there a few examples of *C. cælestimontana,* while on the slopes of the hills *Parachondrula aptycha* is present in fair numbers. The snails dig themselves into the soil and are difficult to find, but the following list is representative of the area as a whole: *Parachondrula aptycha, Cathaica semenowi, C. cælestimontana, Ena asiatica, Parachondrula secalina, Pupilla sterri, Fruticicola lantzi,* and *F. mesolenca.* The snails which inhabit this region adopt a number of precautions in order to avoid being killed by the summer heat.

The meadow part of this area is considered under the following heads: That covered with tall grass; that with close, dense grass; the region of the river valleys; and the ravines. The first has either no snails or very few of the species *Vallonia costata, V. pulchella, Pupilla sterri, Isthmia strobeli, Succinia evoluta* and *Ena maibulaki.* The second has the *Parachondrula,* the *Cathaica,* the *Pupilla, Fruticicola,* and the *Phenacolimax,* while the river valleys provide the richest collections, in which all the species so far enumerated are found together with examples of *Macrochlamys, Heinemannia* and *Gallandia.* The ravines, besides harbouring *Heinemannia* and *Macrochlamys,* also provide a refuge for *Pseudiberus transiliensis,* which is to be found nowhere else. The orchard areas provide specimens of *Macrochlamys, Heinemannia, Parachondrula, Fruticicola, Phenacolimax* and *Ena.*

The Subalpine Region. Situated 2,000 to 3,000 metres above sea-level and possessing deep defiles and ravines, and at the same time wide, shallow valleys and gently-sloping hills. The flora here is of the following order: *Poa pratensis, Phleum buchneri, Dactylus glomerata, Trisitum virescens and Geranium,* and this constitutes the soft-meadow grass area in contradistinction to the steppe region where the fescues are predominant. In the first of these areas there is no snail population at all, while the fescue pastures provide only rare examples of *Cathaica cælestimontana.* The subalpine river valleys are the basic reservoir for the snails, and here *Ena, Parachondrula, Fruticicola, Vallonia and Heinemannia* are well represented, although showing a number of variations from the snails of the same species living at lower altitudes. The coniferous forests of the region harbour enormous numbers of *Succina altaica* and *S. evoluta,* while under the stones *Phenacolimax regulosa* may be found, together with *Pupilla* and *Macrochlamys.* The belt of *Juniperus turkestanus* provides specimens of *Succinia* and *Columella,* both of which are to be found close to the bushes and not out in the open.

The Alpine Region, at 3,000 to 3,300 metres above sea-level, with its fescues, failed to provide any specimens of snails, nor were any to be found in the snow on the summits of the mountains. R.H.A.M.

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REVIEWS

HUNTING SKETCHES, by Anthony Trollope, with introduction and illustrations by Lionel Edwards. London: Ernest Benn. Price 15s. net.

ANTHONY TROLLOPE was a fortunate man. He lived in the days when the air and countryside were not polluted by the noise and pantings of the internal combustion engine, and when the horse was king. In his day a man could live in affluence on a salary or income which in this year of grace is deemed to be scarcely sufficient to provide a labourer with the essentials of life.

Trollope's *Hunting Sketches* are as true to-day as they were when they were penned. They demonstrate that the science and art of hunting has not changed very much. The greatest change is in the type of the follower. It is no longer the sport of the privileged few. It is more democratic and many who show themselves well to the fore in 1952 would have been frowned upon as intruders even as late as twenty years ago. Trollope's dissertation on the people who followed hounds in his day applies equally well to their modern counterparts. Probably one should make an exception as regards the Hunting Parson. Nowadays he is almost as extinct as the Dodo but not for the same reason. Many have the will but not the means for the stipend of a modern incumbent is scarcely sufficient to provide him with a cycle much less a horse.

The man who hunts and does not like it is still with us. He hunts for the same reason that causes others to patronise the opera or the arts. It is the thing to do.

We still have the man who hunts and likes it and he is the very backbone of the sport. One good day still wipes out the memory of all the bad ones and whets his appetite for more.

Trollope draws aside the veil and tells us of the man who never jumps. He still flourishes and enjoys himself. He knows his country, he knows the ways of Charlie, and by putting two and two together there he is at the kill without giving a moment's anxiety either to himself or to his mount. If this method was more widely known, the timorous would take heart and large fields would be an embarrassment to many a M.F.H.

The Hunting Farmer sketch is topical to-day. Agriculturists are prosperous again. Farmers are amongst the selected or fortunate few who can afford to hunt. This is good, for hunting depends on the good will of the farmers. One would wish that modern hunting farmers were as "sartorily" inclined as their forefathers. It looks bad to hunt in a cloth cap and gum boots.

We will not comment on the M.F.H. and the ladies. He would be a brave man who dared to criticise them.

The last sketch, "How to Ride to Hounds," we commend to all. It should be read and digested like the highway code. If its precepts are implemented then much cyanosis of face, neck and language, could be avoided.

We must thank the publishers for making these delightful sketches available again, and Lionel Edwards for his foreword and the sketches. No man

can put more form and life into a horse or hound, and I am sure that I can smell that fox which is slinking away on the page opposite 136.

HERDMANSHIP, by Newman Turner. London: Faber & Faber. Price 18s. net.

NEWMAN TURNER has propounded many original ideas on how to farm, how to establish and run a herd and how to prevent and treat disease.

In this book he sets forth these views for the benefit of others. The book is divided into four sections and there are five appendices. The latter fill 67 pages, almost a quarter of the entire tome. Sections 1, 2 and 3, deal with the management of the herd, *i.e.*, how to establish one, practical breeding, simple genetics, herd efficiency, economics, showing and judging, cattle sales and milk production. All this material makes very interesting reading and it can be studied with profit by any herdsman. Section 2, on the Showing and Judging of Dairy Cattle, is particularly good and the excellent illustrations will repay careful study.

Mr. Turner writes in a simple, easy style, and he makes his argument convincing and sound whilst he confines his attention to what can truly be described as Herdmanship. It is when he ventures into the realms of Veterinary Science that it is no longer possible to be his ardent follower. He says, "There is only one disease of animals and its name is man." This may be true in some measure for we have all been told that "man is vile," but why does he not complete his own arguments and say that "there is only one preventative and cure of disease and its name is Garlic."

Really Mr. Turner, you are more obsessed with the merits of Garlic than is any Italian cook.

It is a pity that the author should mar a most interesting and informative book by a recitation of his adventures as a "Cow Leach." Veterinary surgeons, on the whole, are not stupid or obstinate men. They are not averse from trying new methods or medicaments, but they fight shy of the "cure all" and their training and experiences make them suspicious of 100 per cent recovery claims.

Having waded through this "farrago of nonsense" on the prevention and treatment of disease in cattle it is refreshing to turn the page and come to Appendix 2. This is titled "The Why and How of the Breeds." This appendix is done extremely well and the author has called in men and women of authority to give their views on the points and qualities of the various breeds. Such information is very valuable and especially so to veterinary students, who seek a succinct account of the points of the various breeds of cattle.

Finally, one must congratulate Mr. Turner and his publishers on the excellence of the 50 illustrations and the choice thereof.

HOME DOCTORING OF ANIMALS, by Harold Leeney, M.R.C.V.S. Revised by C. Greatley Saunders, D.S.O., Dr. Vet. Med., M.R.C.V.S. London: Farmer & Stockbreeder Publications, Ltd. Price £2 2s. net.

BOOKS like *Home Doctoring of Animals,* are no doubt produced for the education of amateurs. At one time such a book would have met with the

profound disapproval of the qualified men and led to many indignant letters in the professional press, and author would be accused of " letting the side down." I am afraid that the real basis of such antagonism was economic, not scientific. Of course this opposition only served to advertise the book. It sold in great numbers, and strange to relate the result with the reader was the exact opposite to what he or professional opponent had anticipated. The purchaser was made very much disease conscious. In consequence he sought professional advice and comfort with greater frequency than had previously been the custom. His amateur efforts often led to disaster. One client of mine presented me with his handsome milk fever outfit after he had ruined the udders of six valuable milch cows. Veterinary surgeons profited in direct relationship to the popularity of the book in their areas.

This book is probably the best of its kind. From the point of view of the animal owner its greatest defect is that the author has made it too " professional," *i.e.*, he presumes that the reader's basic knowledge of the fundamentals of anatomy, physiology, pathology and pharmacy is of a high standard. This is not the case and in consequence much of the text is undoubtedly beyond the comprehension of the average layman.

The reviser makes the same mistake, for he has brought the book even nearer to the standard of a professional text book. He would have enhanced its value to its potential public if he had simplified the text and increased the number of illustrations and attached appropriate legends. The legend under Fig. XI is likely to mislead.

CORRIGENDUM

In our November issue, in the article by E. J. H. Ford, M.R.C.V.S., " The Treatment of Johne's Disease in Cattle," the following reference was unfortunately omitted :—

McAleer, W. B. (1948): *Irish Vet. Jnl.*, 2, 48.

Publishers' Notices

The British Veterinary Journal, with which is incorporated The Veterinary Journal, is published monthly, and copy for advertisements should be in the hands of the advertisement manager not later than the 20th of the preceding month, if proof is required. Tel.: Temple Bar 3386.

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